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Brief high impact exercise increased cortical mass and trabecular density at regions predictive of femoral neck and trochanteric fracture [Abstract]

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BRIEF HIGH IMPACT EXERCISE INCREASED CORTICAL MASS AND TRABECULAR DENSITY AT REGIONS PREDICTIVE OF FEMORAL NECK AND TROCHANTERIC FRACTURE

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Background: Reduced cortical mass and trabecular density at discrete regions of the proximal femur were recently found to predict fracture at the femoral neck and trochanter. Furthermore, brief, multidirectional, unilateral hopping exercises increased femoral neck bone mineral density of the exercise leg. Substantial localised variation in response across the proximal femur was observed however, and it is not known whether regions predictive of fracture were affected.

Objective: This study aimed to determine whether cortical mass and trabecular density in regions predictive of femoral neck and trochanteric fracture were influenced by brief multidirectional exercise.

Methods: Participants were men aged mean (SD) 70 (4) years. They took up brief daily multidirectional hopping exercises on one randomly selected leg. Quantitative computed tomography scans of the proximal femurs were performed at baseline and after 12 months of exercise. Cortical bone mapping was used to calculate changes in cortical mass surface density (CMSD) and endocortical trabecular density (ECTD) at regions predictive of femoral neck and trochanteric fracture. Differences in response between exercise and control legs were detected using paired t-tests.

Results: CT scan data were available for 34 men. At the femoral neck fracture region, there were significantly greater increases in the exercise than control leg in CMSD [+7.7 (5.7) versus +4.8 (6.3) mgcm^{-2} ; $P < 0.001$] and ECTD [+10.5 (8.9) versus +6.9 (9.6) mgcm^{-3} ; $P = 0.008$]. Similarly, at the trochanteric fracture region, there were also significantly greater increases in the exercise than control leg in CMSD [+6.7 (5.5) versus +3.4 (6.1) mgcm^{-2} ; $P < 0.001$] and ECTD [+9.5 (8.7) versus +6.3 (9.7) mgcm^{-3} ; $P = 0.021$].

Discussion: The increases in the exercise leg amounted to ~3% of baseline CMSD and 5-6% of ECTD (compared to 1-2 and 4% respectively in the control leg).

Conclusion: Brief daily exercise significantly increased cortical mass and endocortical trabecular density at regions predictive of both femoral neck and trochanteric fracture. Cortical bone mapping may allow detection of changes in fracture risk associated with interventions that produce localised adaptations in bone.